

Notes on Braconidae (Hymenoptera) Associated with Jojoba (*Simmondsia chinensis*) and Descriptions of New Species

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Abstract. — A brief review is given of 13 species of Braconidae that were associated with insects feeding on jojoba, *Simmondsia chinensis*, in the southwestern United States. In addition to host and distributional data, four new species and one new genus are described.

Jojoba, *Simmondsia chinensis* (Link) Schneider (Buxaceae), a shrub native to the southwestern United States, has recently been studied for its economic potential as an oil producer (Sherbrooke and Haase, 1974; Scarlett, 1978; Yermanos, 1979). In conjunction with this, studies have been undertaken recently to survey the arthropods associated with jojoba (Pinto and Frommer, 1980, 1984; Pinto et al., 1987). During these studies I was asked to identify the Braconidae that were collected, and this paper is a review of those species and is intended to provide names and taxonomic information important for future studies on the biological control of jojoba pests.

This review covers only those Braconidae that were actually reared from a host insect attacking jojoba branches or leaves, or where there was little doubt of host association with an insect from the plant. Of the 13 species collected, four are described as new, including one new genus. All of the braconid and host specimens are deposited in the collection of the University of California, Riverside (UCR) except the holotypes and some paratypes of the new species which are in the U.S. National Museum of Natural History, Washington, D.C. (USNM) and the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts (MCZ).

KEY TO SPECIES OF BRACONIDAE ASSOCIATED WITH JOJOBA

Keys to restricted groups of parasites such as this one are limited in their accuracy and may give misleading information to the user. I suggest that braconid parasites associated with jojoba should also be run through the key to North American genera provided by Marsh et al. (1987), which also should be consulted for explanation and illustration of characters mentioned in the key and descriptions below.

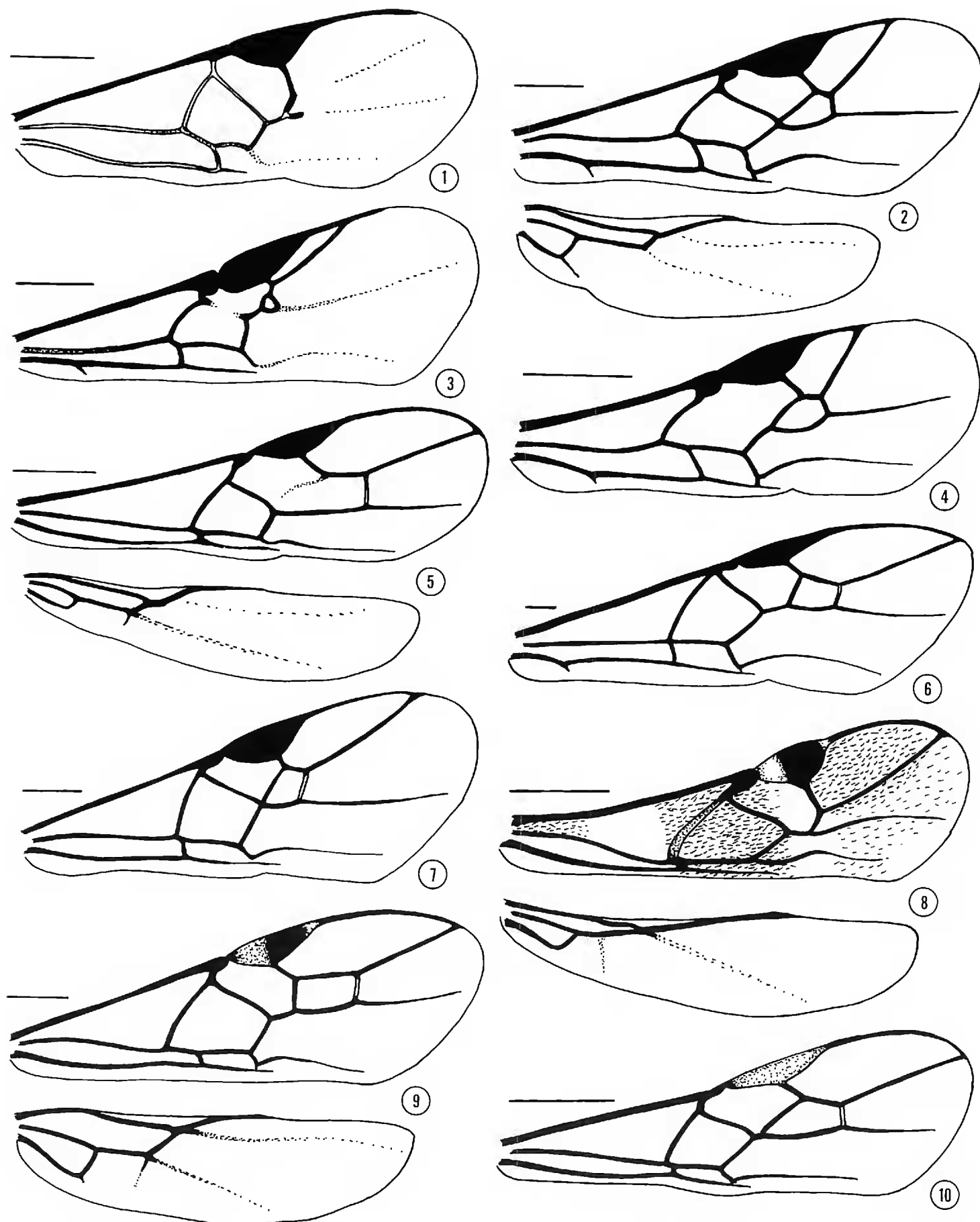
1. Abdominal terga forming a rigid dorsal carapace that covers most of remainder of abdomen 2
- Abdominal terga not carapace like, sutures usually distinct 3

2. First cubital and first discoidal cells of fore wing separated, basal segment of cubitus present (Fig. 2) *Ascogaster shawi*, n. sp.
- First cubital and first discoidal cells confluent, basal segment of cubitus absent (Fig. 4) *Chelonus (Microchelonus) periplocae* McComb
3. Space between clypeus and mandibles forming a circular opening when mandibles closed 4
- Space between clypeus and mandibles absent 7
4. Fore wing with 2 cubital cells, wings mottled (Fig. 8)
..... *Percnobraconoides jojoba*, n. gen., n. sp.
- Fore wing with 3 cubital cells, wings not mottled (Figs. 5, 9, 10) 5
5. First intercubitus of fore wing weak or absent, first and second cubital cells confluent (Fig. 5) *Heterospilus frommeri*, n. sp.
- First intercubitus present, first and second cubital cells separated (Figs. 9, 10) 6
6. Abdominal terga granular; stigma in fore wing uniformly clear yellow, nervulus vein at most slightly beyond basal vein or intersecting basal vein (Fig. 10) *Xenosternum ornigis* Muesebeck
- Abdominal terga longitudinally puncto-striate; stigma brown with basal half and spot at apex yellow, nervulus well beyond basal vein by distance greater than its length (Fig. 9) *Aleiodes buoculus*, n. sp.
7. Forewing with 2 cubital cells (Fig. 1) 8
- Forewing with 3 cubital cells, second cell sometimes small and triangular (Figs. 3, 6, 7) 9
8. Ovipositor longer than abdomen; propodeum with a triangular areola margined by carinae *Apanteles* sp.; *A. aristoteliae* Viereck
- Ovipositor barely exerted and much shorter than first abdominal segment; propodeum without areola, often with a median longitudinal carina *Cotesia* spp.
9. Second cubital cell of fore wing triangular, first cubital and first discoidal cells confluent (Fig. 3) *Bassus binominata* (Muesebeck)
- Second cubital cell rectangular or square, first cubital and first discoidal cells separated (Figs. 6, 7) 10
10. First abdominal segment narrow at base, abruptly widening at apex, at least 3 times wider at apex than at base *Meteorus* sp.
- First abdominal segment parallel sided, base and apex nearly equal in width *Homolobus truncator* (Say)

***Aleiodes buoculus* Marsh, NEW SPECIES**

(Fig. 9)

Female. — Length of body, 4–4.5 mm. *Color*: Body generally honey yellow, eyes and ocellar triangle black, mesonotal lobes, mesopleuron, propodeum, and apical abdominal segments frequently light brown; wings hyaline, veins brown, stigma yellow on basal $\frac{1}{2}$ and at extreme apex. *Head*: Eye very large, malar space short, at most $\frac{1}{8}$ eye height; mouth opening small, width only slightly longer than malar space, clypeus swollen; temple small, about $\frac{1}{6}$ eye width; ocelli large, ocellar-ocular distance about $\frac{1}{3}$ diameter of lateral ocellus; face, vertex and temple punctate, frons granulate; antenna with 39 flagellomeres. *Thorax*: Propleuron rugose; mesonotum and scutellum punctate, notauli weakly scrobiculate, meeting in a



Figures 1–10. Wings of braconid species. 1. *Apanteles aristoteliae* Vier., fore wing. 2. *Ascogaster shawi*, n. sp., fore and hind wings. 3. *Bassus binominata* (Mues.), fore wing. 4. *Chelonus (Microchelonus) periplocae* McC., fore wing. 5. *Heterospilus frommeri*, n. sp., fore and hind wings. 6. *Homolobus truncator* (Say), fore wing. 7. *Meteorus* sp., fore wing. 8. *Percnobraconoides jojoba*, n. gen., n. sp., fore and hind wings. 9. *Aleiodes buoculus*, n. sp., fore and hind wings. 10. *Xenosternum ornigis* Mues. Scale line = 0.5 mm.

wide rugose area; mesopleuron granular-punctate, rugose near wing base and at area of sternaulus, sternaulus not distinct; propodeum granular-rugose with a weak median longitudinal carina. *Abdomen*: First tergum slightly longer than apical width, granular-strigate; second tergum granular-strigate; third and following terga

granular-punctate; first, second and sometimes extreme base of third tergum with median longitudinal carina; ovipositor about $\frac{1}{3}$ length of hind basitarsus. *Legs*: Tarsal claw without basal tooth; inner spine at apex of hind tibia $\frac{1}{3}$ length of basitarsus. *Wings* (Fig. 9): Fore wing with first segment of radius $\frac{1}{3}$ length of second segment and $\frac{1}{2}$ length of recurrent vein, nervulus postfurcal by distance greater than its length; hind wing with radiellen sinuate and slightly widening at apex, basella nearly as long as second segment of mediella, postnervellus present.

Male.—Essentially similar to female.

Holotype female.—ARIZONA, Pinal Co., 7 mi W of Superior, 2500 ft, 4 October 1980, "parasite pupa inside geometrid hosts seen 13 Oct 1980, adult wasp emerged 24 Oct 1980." Deposited in USNM.

Paratypes.—4 ♀, 2 ♂, same data as holotype except dates from 4 May 1979 to 7 June 1980. Deposited in USNM and UCR.

The specimens were reared from an unnamed geometrid larva and listed as *Rogas* sp. by Pinto et al. (1987).

This species will key out to the genus *Rogas* in the generic key to North American Braconidae (Marsh et al., 1987) but, according to van Achterberg (1982), most of the species now included in *Rogas* should be placed in *Aleiodes* Wesmael. The genus *Aleiodes* is presently being revised by me and S. R. Shaw. *A. buoculus* belongs to a group distinguished by extremely large eyes and ocelli which contribute to the short malar space and narrow temples; it is separated by its wing venation with the nervulus in the fore wing being beyond the basal vein by a distance greater than its length and by the bi-colored stigma.

The specific name is from the Latin prefix bu- meaning large and the Latin oculus meaning eye.

Apanteles aristoteliae Viereck

(Fig. 1)

Locality.—1 ♀, 5 ♂, CALIFORNIA, Riverside Co., 5.6 mi S of Sage.

Host.—*Epinotia kasloana* McDunnough.

This species, listed by Pinto and Frommer (1984) and Pinto et al. (1987), has been reared from various species of Tortricidae and Gelechiidae but this is the first record for *E. kasloana*.

Apanteles Species A

Locality.—3 ♂, CALIFORNIA, Riverside Co., 5.6 mi S of Sage.

Host.—*Epinotia kasloana* McDunnough.

This species is listed in Pinto and Frommer (1984) as *Apanteles* sp. C and in Pinto et al. (1987) as *Apanteles* sp. Because the specimens are all males it is difficult to accurately identify the species.

Ascogaster shawi Marsh, NEW SPECIES

(Fig. 2)

Female.—Length of body, 3.5–4 mm. *Color*: Black; mandibles brown on apical half; anterior surface of scape, pedicle, and flagellomeres 1–8 orange or light brown; palpi yellow; fore and middle coxae, trochanters, femora, and anterior surface of tibiae honey yellow; apical fifth of hind coxa honey yellow, hind trochanters honey yellow, hind femur varying from honey yellow with black apex to black on entire anterior surface and apical half of posterior surface, apical half of hind tibia honey

yellow, hind tibial spurs yellow, hind basitarsus honey yellow on basal third; fore wing slightly dusky with darker dusky patch below stigma, veins brown, hind wing veins clear. *Head*: Face, vertex, and temple coarsely punctate; clypeus sparsely punctate and shining, lower margin notched medially; frons rugulose, carina between antennae extending onto dorsal third of face; antenna with 30 flagellomeres (broken in all paratypes), flagellomeres 1–8 longer than wide, remainder shorter and more compact. *Thorax*: Pronotum with a dorso-medial depression, coarsely punctate, somewhat areolate anteriorly; mesonotum coarsely punctate, areolate-rugose postero-medially, notauli scrobiculate; scutellum sparsely punctate and shining, pre-scutellar furrow 5–6 foveate; mesopleuron smooth to sparsely punctate medially, areolate-rugose dorsally and along sternaulus; propodeum strongly areolate-rugose, lateral caudal tubercles blunt, median caudal tubercles weak or absent. *Abdomen*: Carapace bicarinate basally, rounded apically, weakly areolate-rugulose; ventral cavity not reaching carapace apex; ovipositor short, not reaching carapace apex when exerted. *Wings* (Fig. 2): First segment of radius about 1½ times longer than second segment, third segment about 3½ times longer than first segment; stigma about 1½ times longer than radial cell along wing margin.

Male. — Essentially as in female.

Holotype female. — CALIFORNIA, Riverside Co., Sec. 32, T.7S, R.1E, Site 2, 116°54'W, 33°31'N, 5.6 mi S Sage on R3, 6 February 1980, S. Frommer. Deposited in USNM.

Paratypes. — 2 ♀, 3 ♂, same data as holotype with dates of 26 February 1976, 25 May 1979, and 27 May 1980, and four of them labelled as reared from *Epinotia kasloana* McD. Deposited in USNM, UCR, and MCZ.

Host. — *Epinotia kasloana* McDonnough. Pinto and Frommer (1984) list this parasite as *Ascogaster* sp. and Pinto et al. (1987) list it as *Ascogaster provancheri* group.

This species will run to *provancheri* Dalla Torre in Shaw's (1983) key to the North American species of *Ascogaster* (couplet 6) but *shawi* is distinguished by the more coarsely punctate face, the weak or absent median caudal tubercles on the propodeum, the less coarsely sculptured abdominal carapace, and the dark markings on the antennae and legs. This species is named for my colleague Scott R. Shaw in recognition of his excellent study of the genus *Ascogaster*.

***Bassus binominata* (Muesebeck)**

(Fig. 3)

Locality. — 1 ♀, 1 ♂, CALIFORNIA, Riverside Co., 5.6 mi S of Sage.

Host. — *Epinotia kasloana* McDunnough.

This species was previously placed in the genus *Agathis* and listed in Pinto and Frommer (1984) and Pinto et al. (1987) as *Agathis* sp., but Sharkey (1985) has recently shown the distinctness of *Bassus* from *Agathis*. This species was known only from the eastern U.S. and this is an unusual extension of its range. It has been reared from various leaf mining Lepidoptera including *Epinotia*, but this is a new record for *E. kasloana*.

***Chelonus (Microchelonus) periplocae* McComb**

(Fig. 4)

Locality. — CALIFORNIA, Riverside Co., Palm Desert.

Host. — *Periploca* sp.

This species, known only from California, was previously recorded by Pinto and Frommer (1980) and Pinto et al. (1987) as being reared from *Periploca* sp. in jojoba leaves. The type series was reared from *P. nigra* Hodges (McComb, 1968).

COTESIA SPECIES

Species of *Cotesia* were included in the genus *Apanteles* prior to the study by Mason (1981). Five specimens which apparently represent two species were reared from jojoba. Because the genus is badly in need of revision and only a few specimens of these species are available, I have chosen to list the species below without specific names.

Cotesia Species A

Locality.—3 ♀, 1 ♂, ARIZONA, Pinal Co., 7 mi W of Superior.

Host.—*Anacamptodes obliquaria* Grote.

This species does not agree with other *Cotesia* reared from *Anacamptodes* and it is possibly undescribed. Pinto et al. (1987) list it as *Cotesia* sp. 1.

Cotesia Species B

Locality.—1 ♀, ARIZONA, Pinal Co., 9 mi W of Superior.

Host.—*Glaucina eureka* (Grossbeck).

I have been unable to find records of any species of *Cotesia*, or any braconid for that matter, reared from this geometrid. This species is also apparently undescribed; it is listed by Pinto et al. (1987) as *Cotesia* sp. 2.

Heterospilus frommeri Marsh, NEW SPECIES

(Fig. 5)

Female.—Length of body, 4 mm; ovipositor, 1.5 mm. *Color:* Head, thorax and abdomen dark brown, abdomen with light brown patches on second tergum and apical terga; antenna brown; legs honey yellow. *Head:* Face, frons and vertex finely strigate, temple smooth; malar space $\frac{1}{2}$ eye height; ocellar-ocular distance about 2.5 times diameter of lateral ocellus; antenna with 22 flagellomeres. *Thorax:* Propleuron rugose; mesonotal lobes finely granulate-strigose; notauli scrobiculate, meeting in a wide rugose area with two distinct carinae; scutellum smooth; mesopleuron smooth with striae around sternaulus, sternaulus impressed but smooth; propodeum rugose with distinct carinae dorsally outlining a central areola and two basal areas. *Abdomen:* First tergum rugose, wider at apex than long; second tergum strigate-rugose; third tergum strigate on basal $\frac{1}{3}$; remainder of terga smooth; ovipositor about $\frac{3}{4}$ length of abdomen. *Legs:* Fore tibia with irregular row of about 20 stout spines on inner edge. *Wings* (Fig. 5): Second segment of radius slightly longer than first segment.

Male.—Unknown.

Holotype female.—CALIFORNIA, Riverside Co., Riverside, UCR Field 4C, September 1985, S. Frommer, emerged Oct.–Nov. 1985, associated with tunnels of *Amphicerus cornutus* (Pallas). Deposited in USNM.

Paratypes.—7 ♀, same data as holotype. Deposited in USNM and UCR.

This species is distinctive by its rugose first abdominal tergum and dark coloration. The type series was reared from jojoba branches which contained only the bostrichid *Amphicerus cornutus*. Although not definitely reared from this

beetle, these were the only insects taken from the plant indicating a likely association of the two species. It is listed as *Heterospilus* sp. by Pinto et al. (1987).

The species is named for its collector, Saul Frommer.

***Homolobus truncator* (Say)**

(Fig. 6)

Locality. — 1 ♀, CALIFORNIA, Riverside Co., 5.6 mi S Sage.

Host. — *Periploca* sp.

This species was listed in the Hymenoptera catalog (Marsh, 1979) as *Zele mellea* (Cresson), which is a junior synonym, and was previously recorded by Pinto and Frommer (1980) as *Zele* sp. It occurs over the entire U.S. and has been recorded from various species of Noctuidae.

***Meteorus* Species**

(Fig. 7)

Locality. — 1 ♀, 1 ?, ARIZONA, Pinal Co., 9 mi W of Superior.

Host. — Undetermined geometrid.

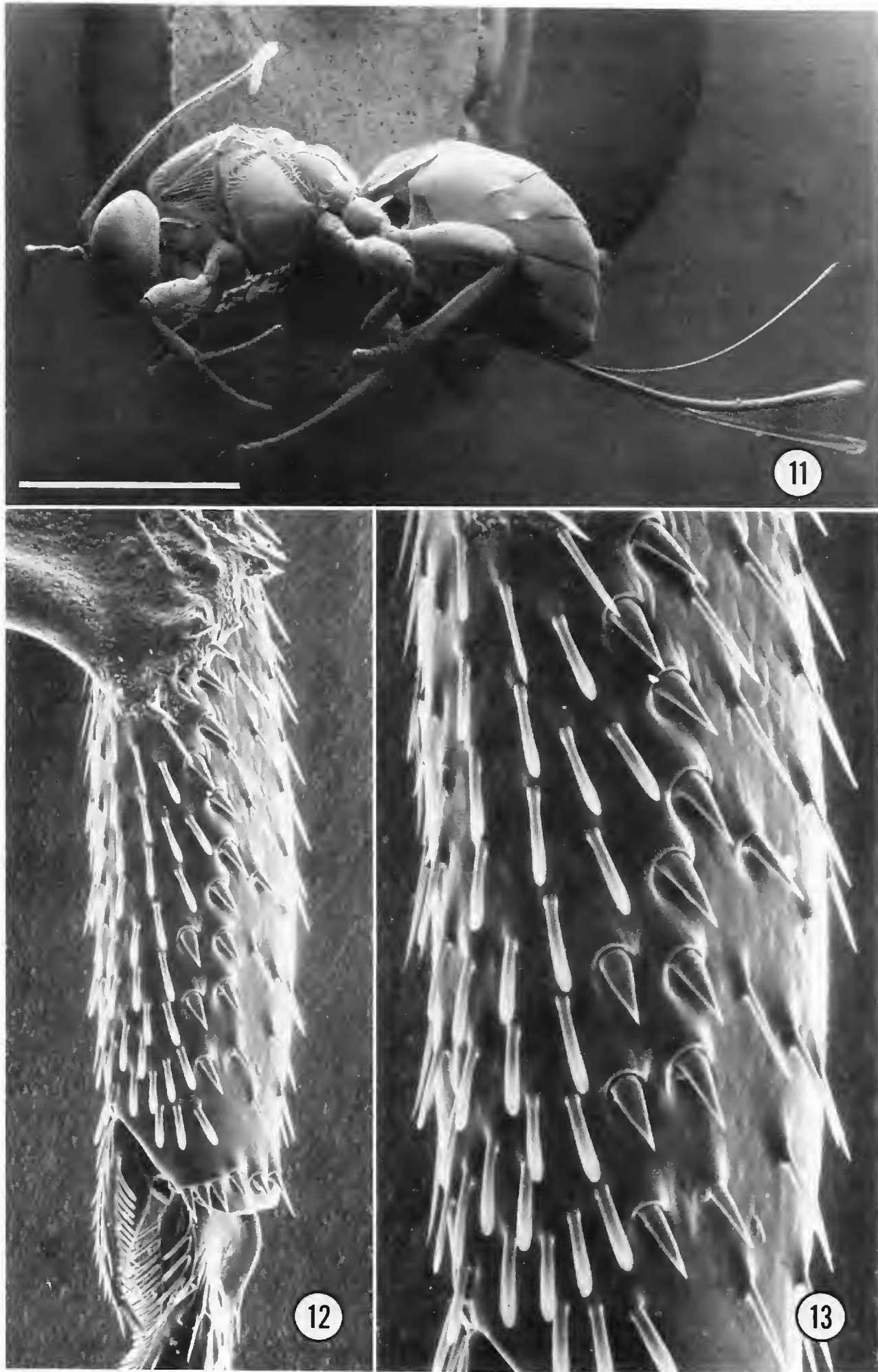
The genus *Meteorus* is also in need of revision and the species are not easily identified. Because of this and the fact that one specimen is missing its abdomen, I am not able to give a specific name. Pinto et al. (1987) list it as *Meteorus* sp.

***Percnobraconoides* Marsh, NEW GENUS**

Type species. — *Percnobraconoides jojoba* Marsh, n. sp.

Diagnosis. — Head cubical, space between clypeus and mandibles circular, distal margin of clypeus concave, labrum concave; mesonotum strongly declivous anteriorly; fore tibia (Figs. 12, 13) with two irregular rows of stout spines on anterior side, spines on outer side normally sharp pointed, those on inner side bluntly pointed; hind coxa with weak basal tubercle on inside; fore wing (Fig. 8) with two cubital cells, radial cell short a wide, last segment of cubitus arcuate, intercubitus about as long as recurrent vein, nervulus present and interstitial with basal vein, brachius weak, first brachial cell open at apex; hind wing (Fig. 8) with radiella absent, cubitella unpigmented and visible only in reflected light, nervellus present, hind wing of male with large stigma at base; abdomen somewhat petiolate, first tergum narrow at base and with strong basal depression (glyma) on each side; ovipositor curved upward.

This genus is distinctive for North America and will run to couplet 145 of the recent key to braconid genera (Marsh et al., 1987) where it can be separated from *Polystenidea* by the stout spines on the fore tibia (Fig. 12). These spines are distinctive for the subfamily Doryctinae to which this genus belongs. In addition to these stout spines, the inner side of the tibia has several rows of unusual spines which are somewhat flat and bluntly pointed, as distinguished from the normal sharply pointed spines on the outer side (Figs. 12, 13). I have not seen this character in any other doryctine genera. *Percnobraconoides* is also similar to the North American genus *Pambolidea* but is distinguished by the femora not being swollen. It is also very similar to the Central and South American genus *Percnobracon* Kieffer, but *Percnobraconoides* can be distinguished by its wing venation, particularly the long first segment of the radius and short second segment of the cubitus in the fore wing and the stigma in the male hind wing, by the first abdominal



Figures 11–13. *Percnobraconoides jojoba*, n. gen., n. sp. 11. Female habitus (scale line = 1 mm). 12. Fore tibia. 13. Enlarged view of spines on fore tibia.

tergum which is much wider at apex than at the base, and by the large glyma at the base of the first tergum.

The generic name refers to the similarity of this genus to *Percnobracon*; the gender is masculine.

***Percnobraconoides jojoba* Marsh, NEW SPECIES**

(Figs. 8, 11–13)

Female (Fig. 11).—Body length, 3–4 mm; ovipositor length, 1.5–2 mm. *Color*: Head, basal $\frac{2}{3}$ of antenna, and legs honey yellow; thorax and first abdominal segment red-brown; apical $\frac{1}{3}$ of antenna and remainder of abdomen black; fore wing banded. *Head*: Granulate-rugose, malar space strigate; antenna with 16–21 flagellomeres; eye large, malar space about $\frac{1}{3}$ eye height, temple about $\frac{1}{2}$ eye width; ocelli small, ocellar–ocular distance 2.5 times diameter of lateral ocellus. *Thorax*: Mesonotum sharply declivous anteriorly; notauli absent, mesonotum costate-granulate, scutellum granulate; propleuron costate-granulate; mesopleuron finely granulate, sternaulus deeply sulcate and smooth, subalar groove rugose; propodeum rugose dorsally and laterally, finely granulate on sides and on dorsal basal areas on each side of median rugose area. *Abdomen*: First tergum slightly longer than apical width, narrowed sharply at base, longitudinally costate-granulate with two conspicuous raised basal carinae and deep depression (glyma) at each side; second tergum costate-granulate, remainder of terga granulate; ovipositor a little longer than abdomen and curved upward. *Legs*: Fore tibia (Figs. 12, 13) with irregular rows of stout spines on anterior side, spines on outer side normally sharply pointed, those on inner side bluntly pointed; hind coxa with weak basal tubercle on inside. *Wings* (Fig. 8): Fore wing with two cubital cells, radial cell short and wide, last segment of cubitus arcuate, intercubitus about as long as recurrent vein, nervulus present and interstitial with basal vein, brachius weak, first brachial cell open at apex; hind wing with radiella absent, cubitella unpigmented and visible only in reflected light, nervellus present.

Male.—Essentially as in female; hind wing with large stigma at base.

Holotype female.—ARIZONA, Pima Co., Tucson Mountains, Saguaro National Monument West, Red Hill, 3 March 1980, J. Cicero collector, reared from dead jojoba branches. Deposited in U.S. National Museum.

Paratypes.—1 ♂, same data as holotype. 1 ♀, MEXICO, Guaymas, 10 April 1938, R. H. Crandall collector. Deposited in USNM and UCR.

The type specimens were reared from branches of jojoba but not associated with any specific host insect. Frommer (per. comm.) mentions that a bostrichid, *Amphicerus cornutus* (Pallas), was also collected from the same jojoba plants and it could be the host of the wasp.

The specific name comes from the common name for the plant *Simmondsia chinensis* (Link) Schneider from which the specimens were reared.

***Xenosternum ornigis* Muesebeck**

(Fig. 10)

Locality.—CALIFORNIA, Riverside Co., Palm Desert.

Host.—*Periploca* sp.

This species was reported by Pinto and Frommer (1980) and Pinto et al. (1987).

It was previously recorded from the southern plains states and has been reared from the gelechiid *Fascista cercerisella* (Chambers).

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